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Figure 15B is a front view of an embodiment of a laser diode module.

Figure 15C is a front view of another embodiment of a laser diode module.

Figure 16A is a top view of an upper plate.

Figure 16B is a side view of an upper plate.

Figures 17A-C illustrate a preferred embodiment of the invention where a counter-clockwise rotation of a thumb screw causes the spirit vial bubble to move to the left.

Figure 18 is a side cross-sectional view of a leveling system.

Figure 19 is a top view of a leveling plate.

Figure 20 is a front cross-sectional view of the leveling system.--

On page 7, line 19, please insert the following:

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--A suitable collimating laser diode module is part no. 06DLL645 made by Melles Griot Inc. of Boulder, CO.--

On page 23, at line 15, please insert the following:

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--Figure 15A is a cross-sectional view of another embodiment of the laser diode module 199. In this embodiment, the laser diode module 199 includes an outer casing 200 preferable made from a rigid metal such as brass. As shown a hole 201 is machined in the left side of the outer casing 200. The hole 201 includes a threaded section 204 which extends from the left outer edge of the outer casing 200 towards the central portion of the outer casing 200. A lens 206 is pressed into a cylindrical lens mount 208. A suitable lens is part no. M23,021 available from Edmund Scientific Company of Barrington, New Jersey. A suitable cylindrical lens mount 208 can be fabricated out of injection molded ABS plastic. The cylindrical lens mount 208 preferably includes threads on the outer surface that mate with the threaded section 204 of the hole 201. The lens mount 208 holding the lens 206 is screwed into the threaded section 204. A second hole 205 is machined into the outer casing 200. The second hole 205 is concentric with the first hole 201. The diameter of the second hole 205 matches the diameter of a laser diode 209. A suitable laser diode 209 is part no. HL6714G made by Hitachi America, Ltd. of Brisbane, CA. The second hole 205 preferable fits the laser diode 209 very snugly so as to promote thermal conduction to dissipate the heat generated by the laser diode 209 during normal operation. A third hole 207 is machined into the right side of the outer casing 200 and is concentric to the second hole 205. The second hole 205 connects the holes 201 and 207. The laser diode 209 is mounted to a spacer 212 and is soldered to a printed circuit board (PCB) 211. Also on the PCB 211 is a power supply circuit 214 to drive the laser diode 209. A suitable spacer 212 is preferably fabricated out of plastic. A suitable power supply circuit 214 is the power circuit shown on page 35 of application note 465-5445 from Toshiba America Electronics Corporation of Sunnyvale, California. The positive terminal of the power supply circuit 214 is wired to the outer casing 200. The ground of the power supply circuit 214 is wired to a solder point 213 on a connector board 216. When assembled, the solder point 213 is aligned with the mechanical axis of the outer casing 200. A suitable material for the connector board 216 is a conventional PCB material. Insulation is applied to the inside of the hole 207 so as to fix in place: the laser

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diode 209, the spacer 212, the PCB 211, and the connector board 216. A suitable insulation material is Plasti-Dip made by PDI of Circle Pines, MN.

When fully assembled, a positive voltage, for example 4.5 V, is applied to the outer casing 200 and ground is applied to solder point 213 causing the laser diode 209 to lase. At this point the lens mount 208 containing the lens 206 is screwed along threaded section 204 until the laser focuses to a 5-10 mm spot on a target approximately 5 meters away. The exact spot size and distance are not critical. An outer shoulder 202 is machined along the left edge of the outer casing 200. The shoulder 202 surrounds the outer casing 200 and is centered about its mechanical axis. Although the shoulder 202 is shown in Figure 15A on the left side, the shoulder 202 can be anywhere along the length of the outer casing 200.

Figure 15B is a view of the laser diode module 199 taken along the line J-J. A set of ridges 215 are machined along the edge of the outer shoulder 202. The exact number of ridges 215 around the shoulder 202 is not important. In still another embodiment shown in Figure 15C, the shoulder 202 has a number of holes 217 along the perimeter of the shoulder 202. Referring to Figure 7, the laser diode 199 is inserted into the cylindrical hole 38. The shoulder 202 stops the laser diode 199 from sliding through the cylindrical hole 38. The ridges 215 or holes 217 can be used to rotate the laser diode module 199 around the mechanical axis of the cylindrical hole 38. Thus the laser diode module 199 is extremely conducive to the alignment method described earlier, for example, at pages 9-11.

Figure 16A is a top view of an integral upper plate for aligning a set of spirit vials with respect to a rotating shaft. An upper plate 250 is preferably machined out of a rigid material such as aluminum or die cast aluminum alloy 383. A hole 252 is machined perpendicular to the top surface 251 of the upper plate 250. Referring to Figure 16B, a front view of the upper plate 250 taken along line K-K, and Figure 8, the bottom surface 253 of the upper plate 250 is preferably attached to the top surface 9 of the upper case 2. Referring to Figures 16A and 8, the hole 252

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is machined to be the same diameter and concentric to the circular orifice 5. As before in Figure 8, the hole 252 shown in Figure 16B will determine a Z-axis of rotation. As shown in Figures 16A-B, two holes 254, 256 are machined to be perpendicular to the hole 252. The mechanical axis of the hole 256 determines a Y-axis which is perpendicular to the Z-axis of rotation. The mechanical axis of the hole 254 determines an X-axis which is also perpendicular to the Z-axis of rotation. Two cylindrical spirit vials 255, 257 are inserted into the holes 254, 256, respectively. A suitable vial is part no. 0349 made by Empire Level Mfg. Corp. of Milwaukee, WI. Referring to Figure 16B, the upper plate 250 includes an arm 260 which includes a machined hole 258. The hole 258 is offset and parallel to the hole 252. A cylindrical spirit vial 259 is inserted into the hole 252. A suitable vial 259 is part no. 0224 made by Empire Level Mfg. Corp. of Milwaukee, WI.

In the horizontal orientation illustrated in Figure 8, if the vials 255, 257 are leveled the laser level 1 will project a level horizontal plane of laser light. In the vertical and plumb orientation illustrated in Figures 13A and 13B, if the vial 258 is leveled then the laser level 1 will project a vertical plane of laser light that is perpendicular to a level horizontal plane. The upper plate 250 eliminates the need to machine the top surface 3 to be perpendicular to the circular orifice 5 as shown in Figure 8. It also eliminates the need to machine the bottom and top surfaces of the caps 76 and 78 to be flat and parallel as shown in Figures 10-11.

In an alternate embodiment of the invention, Figure 18 illustrates a cross-sectional view of a leveling system. The leveling system consists of three major components: a bottom plate 280, a leveling plate 284, and a base plate 296. All three components are preferably machined from a rigid material such as aluminum. A suitable alternative material is injected molded polypropylene plastic. The bottom plate 280 includes a locating bracket 281 integrally extending from the top left side of the bottom plate 280. A locating hole 283 is machined into the locating bracket 281.

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Figure 20, a front view of the leveling system, shows a corresponding locating bracket 285 and a locating hole 287 on the right side of the bottom plate 280. The locating brackets 281, 285, and locating holes 283, 287, are used to locate the lower case 4 as shown in Figure 8 on the bottom plate 280. The distance between the inside of the locating brackets 281, 285, corresponds to the width of the lower case 4. Two holes (not shown) are machined and threaded in the lower case 4 so that they are concentric to the locating holes 283, 287, when the lower case 4 is placed on the bottom plate 280. A thumb screw 289 and a corresponding thumb screw (not shown) is used to lock the lower case 4 to the bottom plate 280. A suitable thumb screw is part no. 9T41-B8399116 made by Stock Drive Products of New Hyde Park, New York. A half hinge 282 integrally extends along the right bottom edge of the bottom plate 280.

Figure 19 is a top view of the leveling plate 284, including a matching half hinge 291 extending from the right top edge of the leveling plate 284. Referring to Figures 19 and 20, a pin 293 couples together the half hinges 282 and 291. A suitable pin 293 is part no. A9Y35-0444 made by Stock Drive Products of New Hyde Park, New York. The half hinges 282, 291, are machined and assembled so that the bottom plate 280 pivots around the pin 293. An U-shaped or circular-shaped mitt 305 integrally extends from the bottom, front, center of the bottom plate 280 as shown in Figure 20. A steel ball 292 of slightly larger diameter than the inner opening of the mitt 305 is press fit into the mitt 305. A suitable steel ball is part no. A9Y71-06 made by Stock Drive Products of New Hyde Park, New York. Attached to the bottom left corner of the bottom plate 280 is one end of a biasing spring 306. A suitable spring is part no. S78ESY-006008025 made by Stock Drive Products of New Hyde Park, New York. The other end of the spring is attached to the top left corner of the base plate 296.

Figure 19 is a top view of the leveling plate 284, including two holes 307, 308, which are machined into the left center and front center of the leveling plate 284, respectively. The holes 307, 308 are perpendicular to each other. Thumb screws 298, 299 are inserted respectively into the holes 307, 308. A suitable thumb screw is part no. 9T41-R8399134 made by Stock Drive

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Products of New Hyde Park, New York. The thumb screws 298, 299 can be held in place using retainer rings 309, 310, respectively. A suitable retainer ring is part no. A9Q290-15 made by Stock Drive Products of New Hyde Park, New York. Two adjustment blocks 290, 302 are threaded onto respectively the thumb screws 299, 298. The width of the blocks 290, 302 fit within the holes 308, 307, respectively. Suitable adjustment blocks 290, 302 are preferably machined out of brass and then nickel plated. As shown in Figures 18-20, the adjustment blocks 290, 302, each include an inclined surface 311, 312, respectively. As shown in Figure 20, the inclined surface 312 of adjustment block 302 contacts the ball 304. As shown in Figure 18, the inclined surface 311 contacts the ball 292. The adjustment blocks 290, 302 include threads matching the threads of the thumb screws 299, 298. As the thumb screws 298, 299 are rotated the adjustment blocks 302, 290 move along the length of the holes 307, 308. A half hinge 294 integrally extends from the bottom, left rear corner of the leveling plate 284.

Referring to Figure 18, a matching half hinge 295 integrally extends from the top left side of the base plate 296. A pin 297 couples together the two half hinges 294 and 295. A suitable pin 297 is part no. A9Y35-0444 made by Stock Drive Products of New Hyde Park, New York. The half hinges 294, 295 are machined and assembled so the leveling plate 284 pivots around the pin 297. An U-shaped or circular shaped mitt 303 integrally extends from the top center of the base plate 296. A steel ball 304 is press fit into the mitt 303 as described earlier. A suitable steel ball 304 is part no. A9Y71-06 made by Stock Drive products of New Hyde Park, New York.

When the leveling system is assembled, the bottom plate 280 rests above the leveling plate 284, which in turn rests above the base plate 296. The steel ball 292 is coupled tightly to the adjustable block 290 due to the tension of the spring 306 (Figure 20). As the thumb screw 299 is rotated counter-clockwise the adjustment block 290 will move to the left. Because of the inclined surface 311 of the adjustment block 290, the bottom plate 280 will pivot about the pin 293. Figure 18 is one orientation of the block 290 such that a counter-clockwise rotation of the thumb screw 299 will raise the bottom plate 280 about the pin 293. Rotating the adjustment

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block 290, 180 degrees will cause a counter-clockwise rotation of the thumb screw 299 to lower the bottom plate 280 about the pin 293.

Referring to Figure 20, the steel ball 304 is coupled tightly to the adjustable block 302 due to the tension of the spring 306. As the thumb screw 298 is rotated counter-clockwise the adjustment block 302 will move to the right. Because of the lower inclined surface 312 of the adjustment block 302, the leveling plate 284 will pivot about the pin 297 as shown in Figure 18. Figure 20 illustrates an orientation of the block 302 such that a counter-clockwise rotation of the thumb screw 298 will raise the leveling plate 284 about the pin 297 (Figure 18). Rotating the adjustment block 302, 180 degrees will cause the counter-clockwise rotation of the thumb screw 298 to lower the leveling plate 284 about the pin 297 (Figure 18).

Figures 17A-C illustrate a preferred embodiment of the invention where the adjustment block 290 is oriented such that a counter-clockwise rotation of the thumb screw 299 causes a bubble 301 to move to the left and a clockwise rotation of the thumb screw 299 causes the bubble 301 to move to the right. Thus, the user can intuitively adjust the laser level 1 for operation.--